



Alberta Conservation Association Chair in Fisheries and Wildlife

DR. MARK S. BOYCE, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGICAL SCIENCES | JUNE 2020



Dr. Mark S. Boyce

Research Summary

On the very first Earth Day in 1970, I volunteered on a local committee to advance environmental science at Iowa State University. Since then my entire career has been devoted to ecology and conservation. Now, after 50 years in ecology and conservation, public awareness of environmental issues has never been greater, with notable demonstrations by young people around the world on climate change and biodiversity loss. Polls associated with the federal election on October 21, 2019, showed that positions on climate change and the environment figured prominently. Climate activist Greta Thunberg addressed a crowd of thousands in front of the Alberta Legislature in Edmonton on October 18, 2019. Driven by this keen interest burgeoning in young people, the University of Alberta now has several new initiatives.

Among these is a new curriculum on Climate Change Science and Adaptation that I am helping to develop in the Faculty of Science.

Climate change has become a significant part of my research program. Consequences of climate change have been most significant in the Arctic, where we have been studying mechanisms behind the decline of migratory herds of caribou. In the Great Plains of Canada, I lead a large research program on grazing management to evaluate how best to maximize carbon sequestration and storage while ensuring maintenance of biodiversity.

Relevance of my research specialty in population biology also became clear this year in context of the COVID-19 pandemic. At the beginning of each lecture in my Population Ecology course during winter term, I took a few minutes to explain how mathematical principles of population biology could help the students appreciate the developing epidemiology of the virus. Obviously this was prescient, resulting in termination of in-class lectures transitioning to online lectures and exams. In national media, I supported Prime Minister Justin Trudeau's cautious approach to modelling COVID-19 projections, given weaknesses and inconsistencies in sampling across Canada. Tragic consequences of the pandemic have focused broad appreciation for principles of population biology such as R_0 , exponential growth, and herd immunity.

Research Progress

We have completed field sampling for our research on grazing management on Canada's grasslands, and most data analysis is complete. Papers emerging from this large project are beginning to appear and have substantial ramifications for public policy, engaging federal and provincial governments on strategies for strategic investment of carbon tax revenues. In addition, we have helped to usher a formal protocol in the Climate Action Reserve, supporting opportunities for investment in carbon credits in Canadian grasslands, with benefits for ranchers and for grasslands conservation. This research funding continues through March 2021, engaging collaboration with several outstanding colleagues at the University of Alberta and elsewhere.

I was an invited keynote speaker at the World Mountain Ungulate Conference in Bozeman, Montana in September, and served on a panel to address the consequences of harvest management on bighorn sheep. This topic has generated considerable discussion in the scientific literature, and my contributions have led to my appointment by Alberta Environment and Parks to a science advisory panel for bighorn management in Alberta.

Additional Accomplishments and Achievements

Several grants were awarded this year to support research in my lab on stone sheep in the Cassiar Mountains, ungulates in Elk Island National Park, and the publication of our completed research on predation of waterfowl nests. My research program led to 20 publications over this past year that covered a diversity of species, including caribou, wolverines, elk, cougars, black bears, grizzly bears, mule deer, white-tailed deer, marten, and waterfowl.



Climate activist Greta Thunberg, Alberta Legislature, October 18, 2019. Photo courtesy Helen Zhang.

On November 23, 2019 I delivered the Distinguished Martha Kostuch Lecture for the Alberta Wilderness Association and was honoured with the Wilderness and Wildlife Defender's Award.

In September, I was invited to give a lecture on "Human Predation on Migratory Elk in Alberta" at a symposium on the Interface of Predation and Migration in Aquatic and Terrestrial Ecosystems at the joint meeting of The Wildlife Society and the American Fisheries Society. This symposium has led to a multi-authored paper to be published in *Trends in Ecology and Evolution*, a journal that enjoys the highest impact factor in ecology.

I presented two webinars this spring on carbon sequestration and storage in grassland soils; one for the Alberta Conservation Association, and one for the Saskatchewan Prairie Conservation Action Plan. These webinars were well attended and are available online.

Last summer, I was retained by the Department of Justice Canada to develop an affidavit supporting the Emergency Protective Order by the Minister of Environment and Climate Change for the Greater Sage-Grouse. Sage-grouse populations continue to decline and are at high risk of total extirpation in Canada as a consequence of extensive development for oil and natural gas in SE Alberta and SW Saskatchewan. Our research has shown that the species is highly sensitive to human disturbances.

Several students working with me have completed their programs this year, including Megan Beale and Samantha Widmeyer, whose MSc research focused on cougars; Mariana Nagy-Reis, who completed her postdoc studies on white-tailed deer in North Dakota; and Camille Warbington, who earned her PhD studying sitatunga in central Uganda. I currently serve on doctoral committees for Upama KC and Antonia Musso, and I supervise MSc research by Grace Enns and Jenny Foca. I was delighted to supervise research projects for several undergraduates this year including Tawnee Dupuis working on bison movements in Grasslands National Park, Carter Case studying grassland vegetation associated with grazing systems, Caitlin Morganson analyzing the interaction between elk and cougars in SW Alberta, Kayley Burke examining asymmetry in skull morphology of marten related to climate change, and Jocelyn Chui and Megan Brownlee studying camera trap data on large mammals in the Mayanja River valley in Uganda. I have been honoured to supervise the work of such dedicated young scholars.

*Bighorn lamb on the Luscar
mine reclamation site near
Cadomin, Alberta*



Research Plans for 2020-21

I have served as the ACA Chair in Fisheries & Wildlife for 21 years; this has been a highly rewarding culmination of my academic career. Being able to conduct research with direct applications to resource management has been particularly rewarding, and I have developed wonderful associations with many wildlife professionals in Alberta.

Restrictions associated with COVID-19 at the University of Alberta have had few consequences for my program. I found it necessary to prepare several lectures and two exams online in spring 2020; albeit time-consuming, this was a minor inconvenience. Graduate student Grace Enns had planned to conduct field studies on stone sheep (*Ovis dalli*) this summer near Dease Lake, B.C., but restrictions on travel to remote First Nations communities precluded this. In spite of this, Grace has adequate data from her radio-telemetry study, and we have a clear plan forward for her MSc, anticipated in December 2020.

Camille Warbington defended her PhD thesis on Google Meets and all went smoothly; she is currently working as my lab coordinator. Jenny Foca has a large number of camera traps deployed in Elk Island National Park and Blackfoot Provincial Recreation Area that need to be collected this spring and summer, and everything is on track for her to complete her MSc within the next year. In the context of COVID-19, I will receive an additional year of support to my Discovery Grant from NSERC, which will continue this funding through March 2022.

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